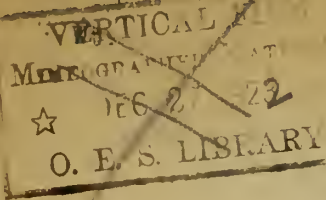


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ReserveMaking and Use of Apple Pectin Sirup in the Home.

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Apple pectin sirup as the term is used in this report, designates an especially rich and concentrated apple juice similar to that ordinarily used for the making of apple jelly, except that the degree of concentration attained is greater. Therefore a comparatively small amount of this sirup can be added to a berry juice or other fruit juice with which it is desirable to use added pectin. The purpose in using it is to make the process of jelly manufacture more certainly successful, and to increase the yield of high-grade jelly by preventing the long boiling of juices which are more or less deficient in natural pectin. It is particularly useful in case of such fruits as the strawberry, the flavor of which is most susceptible to injury by cooking. It is very useful also, in those cases where for some reason the jelly maker has met with disappointment and finds that she has on hand, not a jelly, but a rich, well-flavored sirup. The addition of suitable amounts of pectin to such a sirup secures the desired jelly texture and prevents loss of material.

In order to avoid misunderstanding, let us repeat this statement: Pectin sirups should not be used to conceal the inferiority of watered juices since this can result only in the production of a weak insipid jelly. They should be used only with rich full-flavored juices which are lacking in natural pectin, and therefore could not be successfully used for jelly making, or could be used only after a long boiling period. In other words, pectin sirups should be used only when they improve the quality of the resulting jelly.

The following procedure for making pectin sirup is the one which has been most successfully used in our experiments:

Recipe or Formula

4-1/3 lbs. firm, tart apples, thinly sliced.
5 pints water.

Place in vessel of such size that the water almost covers the apples and that the vessel is not more than three-quarters filled; put this vessel (uncovered) in the steam pressure cooker, bring quickly to 10 pounds pressure, maintain that pressure for 10 minutes, then remove the cooker from the heat and open as soon as the pressure gauge indicates the zero point.

Now strain off the juice through a heavy cloth, in the same fashion as when making jelly. Measure or weigh the strained juice and place it at once in a large-bottomed vessel about 11 inches in diameter.

Boil rapidly until reduced to about one-fifth of the original volume or weight. The pectin sirup is now ready for use. If it is to be preserved for use with fruits which come at a later season, then it may be poured while boiling hot into jars which have been taken out of boiling water and sealed at once with scalded or boiled covers and rubbers.

Suggestions and Precautions to be Observed.

1. Choice of fruit to be used.

The apples should be firm, hard, tart, and underripe rather than overripe. An apple which is insipid in flavor, such as certain strains of Ben Davis, may be successfully used for this purpose, if taken at the proper stage of ripeness; as may also, those apples which are not quite large enough or perfect enough to pass the requirements of a strict system for standardization of fancy grades. Culls which are sound and untainted are often entirely suitable for the making of pectin sirup. It is, however, of no use to attempt the process with mealy, nonacid, very ripe, or overripe apples whose pectin content has been materially decreased by the ripening process.

It may be added, however, that the acid deficiency of these very ripe apples is usually much more marked than their pectin deficiency. Frequently the addition of suitable amounts of lemon juice is sufficient to bring the juice of such apples into proper condition for the ordinary process of jelly making.

A very good quality of pectin sirup can be obtained from the Japanese quince, the fruit of a shrub (*Cydonia Japonica*, the common "burning bush") which is often grown for ornament. These fruits are high in acid and in pectin, and their juice is pleasing in flavor. However, this pectin sirup is so very acid that it masks delicate flavors such as those of most berries, to an undesirable degree. It is therefore more suitable for use with rhubarb, ripe grape, or tomato juice; or the Japanese quince juice may be used with water and sugar according to the ordinary process of jelly making. Combined with the garden quince it makes an especially fine jelly.

2. Preparation of fruit for cooking.

The apples must of course be thoroughly scrubbed and made absolutely clean. They are not cored nor pared, since both parings and corings are rich in pectin. However the pectin made from whole apples rather than from peel and core alone, is usually of much better flavor, since seeds and skin when present in large amount and heavily extracted may give rise to a certain astringency and "off-flavor."

3. Reasons for using the pressure cooker for extracting the pectin; desirability of using a high temperature.

The main factors to be considered in the attempt to secure a sufficiently rich and concentrated juice are these: First, a high temperature is advantageous because it increases the degree of extraction

of pectin in any given interval of time; second, the heat employed for the purpose of extraction and of concentration must be rapidly applied, in order to minimize so far as possible, the danger of destroying or decomposing the pectin. For apparently pectin decomposition depends somewhat more upon the length of the time of heating, and somewhat less upon the temperature at which heating takes place, than does pectin extraction; at least, such appears to have been the case in our experiments.

Table Showing Temperatures Secured in Pressure Cooker.*

Temperature (°F.) Corresponding to pounds of
Steam Pressure.

Lbs. press.	°F.	Lbs. press.	°F.	Lbs. press.	°F.
1	215.2	6	229.5	11	241.0
2	218.3	7	231.9	12	243.1
3	221.3	8	234.3	13	245.3
4	224.2	9	236.6	14	247.3
5	226.9	10	238.8	15	249.1

It is a principle of rather wide applicability that certain kinds of chemical and physical changes may often be no more extensive, if indeed as much so, when a relatively high degree of heat is applied for a comparatively short time, than when a lower degree of heat is applied for a much longer time. This is true, however, only when time and temperature limits are wisely chosen, with due regard for the nature of the substance to be treated and for the results desired. This principle applies to such processes as the making of custard, the roasting of meat, the pasteurization of milk, possibly to the destruction of vitamins in the cooking of foods, and apparently it applies also to the destruction of pectin by heat.

4. The processing temperature must not be too high or too low.

As the temperature rises higher and higher, a point is finally reached at which pectin destruction is so rapid that it is no longer possible to choose a time short enough to cook the apples thoroughly and yet to prevent decomposition of the pectin to an undesirable degree. Therefore, the pressure used in extracting the pectin from apples must not be so high as to cause an undue amount of pectin destruction; yet it should be high enough to hasten the process of extraction and thus reduce materially the time which would be required for cooking at 212°F., by the ordinary methods.

5. Why it is difficult to prescribe times and pressures which will fit all cases.

In practice, it will be found that the time and pressure must be regulated according to the amount of apples cooked at one time, the

* California Agricultural Experiment Station, Circular No. 158, "Home and Farm Canning." By W. V. Cruess.

amount of water in which they are cooked, the diameter of the vessel in which they are placed for cooking, and the amount of surface exposed to the heat of the steam and also for evaporation, for the penetration of heat to the center of the vessel is not instantaneous. Consequently, the larger is the mass of apples to be cooked at one time and the greater the distance from the bottom and walls of the vessel to the center of this mass; then the greater is the degree of heat required to accomplish the desired effect in a given length of time, or else the greater must be the time allowed for the penetration of heat to the center of the mass, at any given temperature.

Time tables suitable for larger amounts of apples than the four-pound lots with which we have experimented, will be forthcoming in the future. Meantime, we suggest that this recipe is a good one with which to make a beginning. It should yield about a pint of pectin sirup, which should make about 4 pints of jelly when used with berries or other fruits which contain a little pectin of their own. It will make between 2 and 3 pints of jelly if used with vinegar or with those fruit juices which contain no pectin at all, or practically none, such as tomatoes.

6. Concentration of strained sirup.

The process of concentration must be carried on in an open kettle over a brisk flame in order to make evaporation as rapid as possible. It must be rapid, for it would be easy to injure the pectin materially if this boiling process be allowed to occupy several hours. It should, as a rule, be complete in half or three-quarters of an hour. Concentration in a vacuum would of course offer ideal conditions, but the open-kettle boiling process here described has been successful in our experience.

Precautions should be observed to prevent burning, especially toward the close of the cooking process.

The finished sirup should be of a rich deep red color, if red-skinned apples are used; very tart; and of a thick, heavy consistency when cold. It will, however, gradually darken somewhat after standing exposed to the air for a few days.

7. Comparison of homemade with commercial apple pectins.

These homemade pectins are not so potent as are some of the pectins which may be bought from certain factories. We have found that it requires about twice as much of our pectin as of the best pectin we can buy, to do the same work. On the other hand, the flavor of pectin made from the whole apples is much pleasanter than is that made from the cores and trimmings, so that the flavor of the resulting jelly is often finer. We have reason to believe that in many instances, the commercial pectins are made largely from cores and peel of apples, or from other by-products of fruit-preserving establishments.

8. Utilization of pectin sirup.

These sirups may be used to make jelly with the nonjellying juices, i.e., to increase the chances of success when making jelly from a juice which is rich in flavor but low in pectin. It is better to

use this concentrated pectin sirup for such purposes, than to use ordinary apple juice prepared for jelly-making by the usual methods, for two reasons. The first is that only about half as much material need be added to fortify the berry or other juice when the pectin sirup is used, as would be the case when using a thinner apple juice; thus the flavor of the berry juice is less diluted. The second is that the heavier pectin sirup is more suitable to can and keep on hand, ready for use at any time.

We have found that it is worth while to use these pectin sirups with strawberry, black or red raspberry, and blackberry juices, either fresh or canned; with the juice of ripe grapes, of sweet nonacid plums and ripe quinces which may contain considerable pectin, but which benefit from the acid of the apple sirup; with rhubarb juice, or even with a tomato juice if the flavor thus secured be fancied. In the case of grapes, an additional advantage is the prevention of the formation of tartrate crystals, which often occurs when jellies made from comparatively ripe grapes stand for some weeks or months. Pear and peach jellies can also be made after this fashion, but their flavor is not much like that of the fresh pear or peach, as a rule. However, when the sirup left from making sweet pickles, preserves, or from open-kettle canning of peaches or pears is available, it is often possible to make a jelly of excellent flavor by adding pectin sirup to it. It can not be expected, however, that such a jelly will be clear or translucent.

This pectin sirup may also be used merely with water and sugar, in case an emergency demands a glass of apple jelly when none is at hand; for of course the flavor of the resulting jelly will be that of the apple sirup. As a rule, however, it is better to make apple jelly by the usual methods. The pectin sirup may also be used with sugar and vinegar, or with mint or rose geranium leaves or with other herbs, or even with lemon juice or lemon extract or any other desired flavor, if such jellies are fancied. In general, however, the lemon, orange, and grapefruit jellies are more attractive when made up with pectin derived from the peel of the citrus fruit. Such pectin has only a very pale yellow color, and this can be used to make a very clear, sparkling amber jelly, which of course could not be the case when red-skinned and brown seeded apples are used as a source of pectin.

Recipe or Formula for Strawberry Jelly,
Fortified with Apple Pectin Sirup.

Crush the berries and heat without the addition of water slowly to the boiling point, and then cook rapidly until very soft; or heat in a double boiler if preferred. Then put the berries into a double layer of cheese cloth to drip.

Add to 1 quart of this dripped juice, 1 cup of apple pectin sirup, 4 tablespoons of lemon juice, and 1 quart of sugar. Boil rapidly until the mixture gives the jelly test, i.e., until the juice sheets from the edge of the spoon. Pour into scalded glasses to cool. When the jelly has set, cover with melted paraffin. The jelly should be bright red in color and should have a decided flavor of fresh strawberry. This amount of material should make about three pints of jelly.

Certain precautions must be rigidly observed in making strawberry jelly of good quality. The berries should be cooked rapidly; if they stand a few minutes too long even in the double boiler, the color darkens and the flavor is not so good. On the other hand, when cooked rapidly over the flame they require very careful watching to prevent burning, even though some of the berries at the bottom be mashed to secure a free flow of juice.

This jelly can be made without lemon juice, but its color and brilliancy are not then quite so fine. When the lemon juice is omitted, a smaller amount of sugar may be used (e.g. three-fourths as much sugar as juice, by volume); but the resulting yield of jelly will not be quite so large.

Jellies may be made from the juices of other berries by this same method. It must be remembered that many of these jellies from small fruits, whether made with or without pectin, are better when freshly made than after some months of storage; in time they darken in color, lose their distinctive flavor more or less, and develop a certain astringency. It is therefore well to use them before they are six months old.

Rhubarb and Apple-Pectin Jelly.

Wash and trim stalks of fresh succulent rhubarb, being careful not to remove the pink skin. Cut into half-inch lengths, and cook in double boiler with the addition of no water, or of only a tablespoon or two in the bottom of the dish. When the rhubarb is tender the juice should be set to drip in a cloth bag. There should be about 1 cupful of juice for each pound of rhubarb, weighed after trimming. Proceed with this dripped juice, according to the directions for strawberry jelly, except that the lemon juice is omitted.

Rhubarb jelly does not in our experience have the clearness and sparkle of a jelly made from red berries; it has rather the appearance of a somewhat cloudy quince or apple jelly. It should, however, retain its characteristic flavor for several months.

If the flavor of the orange or lemon peel be considered desirable in this jelly, a few thin slices may be added to the rhubarb while it is cooking before being dripped.

Recipe for Sweet Vinegar Jelly Made with Apple Pectin Sirup

Add water to the vinegar you wish to use, until it has the degree of acidity you prefer for this jelly. One cup of water added to 1 cup of strong vinegar usually proves satisfactory. To 1 pint of this vinegar mixture, add 3/4 cup of apple pectin sirup, 1 pint of sugar, and a small cloth sack containing a stick of cinnamon and a clove, or any other spice you may care to use. Remove the spice after a few minutes' cooking. Boil until the jelly is secured.

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NOTE - Studies which have been made in this office since the completion of the above-mentioned mimeographed statement, indicate the development of satisfactory methods of making apple pectin without the use of steam under pressure.